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Prevalence of Posttraumatic Stress Disorder in Remotely Piloted Aircraft Operators in the United States Air Force

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14. ABSTRACT

Over the past decade, remotely piloted aircraft (RPA) have become critical military assets. With the proliferation of this unique form of warfare, concerns have been raised regarding the psychological impact such operations have on RPA operators directly engaged in combat-related missions. To our knowledge, this is the first study to assess for prevalence of posttraumatic stress disorder (PTSD) in RPA operators using a comprehensive mental health evaluation using both objective measures (PTSD Checklist-Military Version and exposure questionnaire) and clinical interviews utilizing the Clinician Administered Psychological Survey to determine the nature of the respondents' stressful military experiences associated with onset of symptoms, the severity of symptoms, and whether or not operators who screen positive for PTSD meet the full diagnostic criteria. Two squadrons of RPA operators (pilots and sensor operators) were sampled (N=85). No current cases of PTSD due to remote warfare were identified. Of those reporting higher levels of psychological distress, none identified their engagement in remote warfare as a significant contributing factor. The most endorsed psychological distress items were common depressive/anxiety symptoms, such as sleep problems and anhedonia, which are not specific to posttraumatic stress. We believe our study adds valuable information to previous efforts to document the potential psychological issues of engaging in the modern version of combat.

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1.0 SUMMARY

Over the past decade, remotely piloted aircraft (RPA) have become critical military assets. With the proliferation of this unique form of warfare, concerns have been raised regarding the psychological impact such operations have on RPA operators directly engaged in combat-related missions. To our knowledge, this is the first study to assess for prevalence of posttraumatic stress disorder (PTSD) in RPA operators using a comprehensive mental health evaluation using both objective measures (PTSD Checklist-Military Version and exposure questionnaire) and clinical interviews utilizing the Clinician Administered Psychological Survey to determine the nature of the respondents' stressful military experiences associated with onset of symptoms, the severity of symptoms, and whether or not operators who screen positive for PTSD meet the full diagnostic criteria. Two squadrons of RPA operators (pilots and sensor operators) were sampled (N=85). No current cases of PTSD due to remote warfare were identified. Of those reporting higher levels of psychological distress, none identified their engagement in remote warfare as a significant contributing factor. The most endorsed psychological distress items were common depressive/anxiety symptoms, such as sleep problems and anhedonia, which are not specific to posttraumatic stress. We believe our study adds valuable information to previous efforts to document the potential psychological issues of engaging in the modern version of combat.

2.0 INTRODUCTION

Over the past decade, United States Air Force (USAF) remotely piloted aircraft (RPA), commonly referred to by the general public as "drones," have become critical military assets for providing around-the-clock real-time intelligence, surveillance, reconnaissance; close air support; and precision-strike operations on the battlefield. Rapidly evolving advancements in technology allow drone operators to remain stationed within the nation's borders while being directly engaged in combat operations via real-time high-definition digital media. With the proliferation of this unique form of warfare, concerns have been raised regarding the psychological impact such operations have on RPA operators (pilots and sensor operators) directly engaged in combat-related missions [1].

Recent studies of RPA pilots and sensor operators identified the distinctive operational demands and stressors leading to high levels of self-reported occupational stress. These factors included long work hours (e.g., 6-day work weeks with 1 day off), frequently rotating shift work (e.g., every 30 days), length of shift work (e.g., 10- to 12-hour shifts), and managing the warfighter role with domestic duties [2,3]. Other studies also found higher levels of fatigue in MQ-1 Predator operators compared to traditional pilots due to shift work and length of operational missions [4]. High workloads and lack of manning were cited as potential factors unique to the RPA environment, and approximately 50% of MQ-1 Predator operators surveyed [5] met criteria for occupationally significant fatigue due to shifting work schedules and insufficient opportunity for rest and recovery. Such studies shed light on significant sources of occupational stress among such a unique group of operators.

Other studies have attempted to evaluate the emotional impact of being repeatedly exposed to video and electronic media involving combat-related weapon strikes. One such study that involved a sample of MQ-1 Predator/MQ-9 Reaper operators (n = 1,084) completing the Posttraumatic Stress Disorder Checklist-Military Version (PCL-M) found approximately 4%

endorsed a pattern of symptoms of moderate to extreme severity consistent with diagnostic criteria [6]. The most frequently endorsed symptoms included feeling distant or cut off from others, trouble falling and staying asleep, feeling irritable and having angry outbursts, having difficulty concentrating, and loss of interest in activities previously enjoyed. Such findings are consistent with earlier studies that estimated approximately 3 – 6% of RPA operators (in contrast to 2% of non-combatant airmen from support and logistic units) screened positive using the PCL-M screener with a total cut-off score of 50 [2,3]. The estimated rate of posttraumatic stress disorder (PTSD) for such operators is much lower compared to studies estimating PTSD rates for military members returning from the battlefield, with reported rates ranging from 5-18% [7-10]. In a retrospective cohort study, Otto and Webber [11] compared mental health diagnoses of manned aircraft to RPA pilots. Both groups had statistically equivalent rates of mental health outcomes overall and low rates of PTSD (.7 & .9, respectively). Nonetheless, due to the tracking and killing of enemy combatants and the potential to witness and inadvertently cause allied force and civilian casualties, there continues to be concern regarding the potential for such RPA operators to develop PTSD.

Although the literature assessing the emotional challenges of RPA operations is growing, the previous studies cited above have limitations that may not adequately capture the true prevalence rate of PTSD related to military operations among RPA operators. In general, the studies cited above utilized self-report surveys and screening measures or analyzed past medical diagnoses rather than having direct contact with subjects. Thus, they were not able to comment on whether or not the symptoms of PTSD were directly associated with remote warfare, were caused by some other traumatic event such as a sexual assault or a traditional combat trauma, or were due to other factors not related to PTSD. To our knowledge, this is the first study to assess for prevalence of PTSD in RPA operators using a comprehensive mental health evaluation that includes both objective measures and clinical interviews by licensed, doctoral-level mental health professionals (clinical psychologists and psychiatrists) to determine the nature of the respondents' stressful military experiences associated with onset of symptoms, the severity of symptoms, and whether or not operators who screen positive for PTSD meet the full diagnostic criteria.

3.0 METHODS

3.1 Participants

A total of 85 USAF MQ-1 Predator/MQ-9 Reaper operators (54% pilots, 46% sensor operators) participated in the study. Criteria for participation included being fully qualified to serve in their role as a pilot and/or sensor operator and being engaged in around-the-clock combat-related missions within an Air Force Special Operations Command unit. In total, 55.3% were 18-29 years old and 44.7% were 30 or older. Fifty-five percent were pilots and 45% were sensor operators. A total of 64.7% identified as married, 27.1% reported being single, and 8.2% indicated they were single but in a significant relationship. This study was reviewed and approved by the Air Force Research Laboratory Institutional Review Board.

3.2 Measures

3.2.1 Demographics Questionnaire. Participants completed a brief demographics questionnaire that included items assessing their gender, duty position, squadron, age range, marital status, and hours worked weekly over the past 3 months. Demographic items were purposefully limited to protect the anonymity and confidentiality of participant responses, as well as to promote genuine self-disclosure.

3.2.2 RPA Operational Exposure Questionnaire. This questionnaire is composed of 12 items asking participants to describe the number of events they had witnessed and/or in which they participated. This included how many deaths they had witnessed involving enemy, civilian, and U.S. coalition forces. This included the type of mission and how many episodes (aka missions) they had observed or participated in where they perceived themselves to have direct responsibility regarding deaths.

3.2.3 PCL-M. The PCL-M was used as a screener to assess for PTSD-related symptoms. This is a pen-and-paper self-report inventory composed of 17 items derived from criteria defined in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition [12]. The PCL-M is a widely used clinical screening instrument in civilian and Department of Defense mental health treatment centers. Using a 5-point Likert scale, participants are asked to rate the severity of PTSD symptoms over the past month resulting from military experience or operations. Scores can range from 17-85. Internal consistency and test-retest reliability are both excellent [13].

3.2.4 Clinician Administered PTSD Scale (CAPS). Participants with a total PCL-M score of greater than 37 were interviewed by a licensed USAF clinical psychologist or psychiatrist. The CAPS is a structured, standardized interview to assess and determine the presence of PTSD [14]. It consists of guided questions regarding traumatic events and ensuing frequency and intensity of posttraumatic symptoms rated on a Likert scale. The interview was also used to determine if the causal event for PTSD was due to exposure and/or participation in RPA combat-related operations. The CAPS has demonstrated excellent validity and reliability [15] in assessing for PTSD and is widely used in validation studies.

3.3 Procedure

Prior to conducting the study, squadron commanders were briefed on the nature and purpose of the investigation and agreed to allow such operators the opportunity to volunteer for participation. Squadron commanders acknowledged they would receive no information regarding individual responses unless these included a serious risk to self or others (e.g., reporting an imminent plan to commit murder or suicide). RPA operators who volunteered met as a group in a large briefing room within their operational unit. Participants were briefed by researchers of the nature, intent, and logistics of the study and that participation was voluntary. RPA operators who verbally consented and acknowledged understanding were then administered the demographics questionnaire, RPA operational exposure questionnaire, and PCL-M. Based on previous research with RPA operators [6] and other studies that concluded lower cut-off scores were appropriate for military members [16,17], a clinical cut-off at 38 was established to

identify those who were at risk of PTSD and to be given the CAPS. The clinical interview was conducted in a private office within the worksite of the RPA operator.

4.0 RESULTS

The average PCL-M total score was 25.31 (standard deviation = 9.01) for survey participants with a minimum-maximum range between 17 and 68. A total of 7 (8%) participants had PCL-M scores above 37, which triggered an interview by a licensed, doctoral-level psychologist/psychiatrist utilizing the CAPS (Table 1). These interviews revealed that none of the participants met the full criteria for PTSD. However, two of the participants endorsed previous treatment for PTSD for activities unrelated to remote warfare. One reported treatment in the past for PTSD symptoms subsequent to combat during a traditional deployment and one reported developing PTSD symptoms following a sexual assault. Neither individual met criteria for PTSD based on current symptoms.

Table 1. Participant Responses to RPA Operational Exposure Questionnaire

RPA Operational Exposure Questionnaire	M (SD)
1. How many episodes of ground combat/close air support/human target elimination missions have you witnessed?	34.7 (31.5)
2. In how many of these episodes did you witness enemy deaths as a result of U.S. or coalition fire?	1.7 (19.2)
3. In how many enemy deaths or serious injuries have you directly shared a part of the responsibility?	3.3 (7.2)
4. In how many of these episodes did you witness deaths or serious injuries of U.S. or coalition forces?	1.0 (5.6)
5. In how many missions have you shared the responsibility in the deployment of weapons?	2.7 (25)
6. How many times have you tracked a potential enemy combatant(s) for greater than 1 day and then shared in responsibility for elimination of the combatant?	8.3 (8.4)
7. How many episodes of friendly fire resulting in serious injury or death to U.S. or coalition forces have you observed?	0.7 (5.5)
8. In how many of those friendly fire episodes did you share a part of the responsibility?	0.3 (3.4)
9. How many episodes of unintended severe injury or death to innocent civilians have you observed?	1.7 (5.8)
10. In how many of those episodes did you share a part of the responsibility?	0.3 (2.5)
11. How many episodes of intended severe injury or death to innocent civilians (accepted collateral damage as part of the mission) have you observed?	1.0 (6.0)
12. In how many of those episodes did you share a part of the responsibility?	0.7 (4.3)

M = mean; SD = standard deviation.

For those scoring above the cut-off threshold of 37, the following symptoms were most commonly endorsed in the moderate to severe range: *feeling distant or cut off from other people, trouble falling or staying asleep,* and *having difficulty concentrating* (85.7%); *repeated disturbing memories, thoughts or images of a stressful military experience, feeling very upset when something reminded you of a stress military experience, loss of interest in activities that you used to enjoy, feeling emotionally numb or being unable to have loving feelings for those close to you, feeling irritable or having angry outbursts,* and *feeling jumpy or easily startled* (71.4%) (Table 2).

Table 2. Participant Endorsing PCL-M Items of Moderate to Extreme Severity

PCL-M Items	Participants with Total PCL-M Score <37 (n = 78)		Participants with Total PCL-M Score ≥ 38 (n = 7)	
	n	%	n	%
1. Repeated, disturbing memories, thoughts, or images of a stressful military experience	3	3.8	5	71.4
2. Repeated, disturbing dreams of a stressful military experience	2	2.6	1	14.3
3. Suddenly acting or feeling as if a stressful military experience was happening again	2	2.6	1	14.3
4. Feeling very upset when something reminded you of a stressful military experience	0	0.0	5	71.4
5. Having physical reactions when something reminded you of a military experience	1	1.3	2	28.6
6. Avoiding thinking about or talking about a stressful military experience	2	2.6	4	57.1
7. Avoiding activities or situations because they reminded you of a stressful military experience	2	2.6	2	28.6
8. Trouble remembering important parts of a military experience	1	1.3	1	14.3
9. Loss of interest in activities that you used to enjoy	11	14.1	5	71.4
10. Feeling distant or cut off from people	12	15.4	6	85.7
11. Feeling emotionally numb or being unable to have loving feelings for those close to you	6	7.7	5	71.4
12. Feeling as if your future will be cut short	4	5.1	3	42.9
13. Trouble falling or staying asleep	28	35.9	6	85.7
14. Feeling irritable or having angry outbursts	10	12.8	5	71.4
15. Having difficulty concentrating	4	5.1	6	85.7
16. Feeling jumpy or easily startled	13	16.7	5	71.4
17. Being “superalert” or watchful or on guard	4	5.1	4	57.1

For those scoring below the threshold, the five most commonly endorsed symptoms in the moderate to severe range were: *trouble falling or staying asleep* (37.0%), f*eeling jumpy or easily startled* (18.5%), f*eeling distant or cut off from other people* (14.8%), *feeling irritable or having angry outbursts* (14.8%), and *loss of interest in activities that you used to enjoy* (13.6%).

Table 3 is a univariate analysis of variance showing the relationship between RPA operational exposure and PCL-M total score. There was a significant positive linear relationship between exposure to remote warfare and endorsement of symptoms on the PCL-M, with an F-statistic of 16.51, a p-value of 0.0001, and R^2 value of 0.1611. This meets the requirements for a medium effect size (0.1920). Figure 1 is a graphical representation of the positive linear relationship.

Table 3. Analysis of Variance – Relationship between RPA Operational Exposure and PCL-M Total Score

Source	DF	Sum of Squares	Mean Square	F-Value	Pr > F	R^2	Effect Size
Model	1	1138.5938	1138.5938	16.5100	0.0001	0.1611	0.1920
Error	86	5930.1221	68.9549				
Corrected Total	87	7068.7159					

DF = degrees of freedom; Pr = p-value.

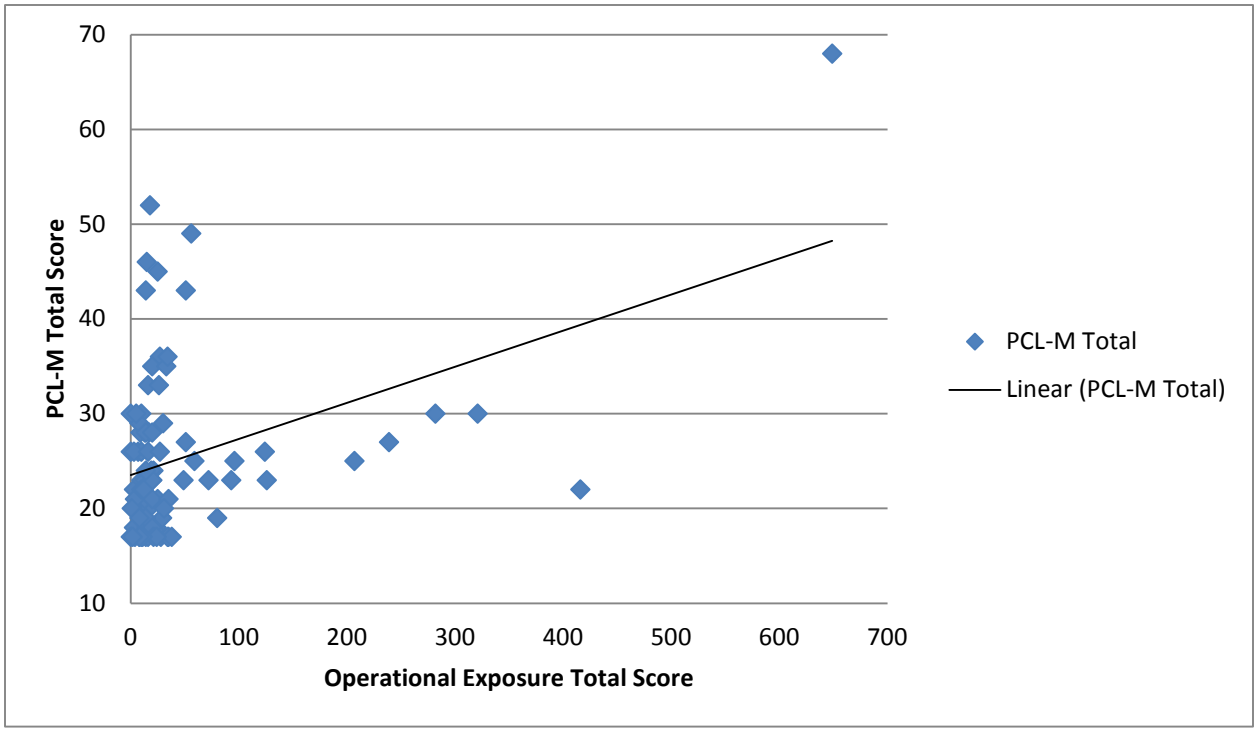

Figure 1. Operational exposure and PCL-M total scores.

5.0 DISCUSSION

The results of this study revealed 8% of participants crossed the screening threshold on the PCL-M (i.e., a total score of 38 or more). However, based on the results of the CAPS interviews, this study did not find any RPA pilots and sensor operators involved in remote warfare who met the full diagnostic criteria for PTSD. These results do not support the notion that RPA operations are associated with higher rates of PTSD than traditional manned aviation operations, similar to a study analyzing the medical diagnoses of RPA and manned airframe pilots that found equivalent rates of PTSD [11]. The two operators who did report previous treatment for PTSD indicated there was no relationship between their diagnosis of PTSD and their work in the RPA career field. Rather, the results of the CAPS interview revealed their treatment of PTSD was related to battlefield deployment and sexual assault. The results, zero of 7 positive screens, also call into question the validity of the PCL-M as a screening instrument in this population.

Although 8% of study participants screened positive for possible PTSD, which is almost twice the rate of the estimated 4-5% in previous studies [2,3], this study used a lower clinical cut-off score (i.e., 38 or more) as compared to the higher cut-off score (i.e., total score of 50). However, if this study utilized the same clinical cut-off, only 2 (2%) participants in this study would have triggered a CAPS clinical interview, which is half the rate of the previous studies and consistent with the estimated rate of airmen in traditional support or logistics (non-high-risk, high-demand) career fields. The results of this study suggest that engaging in combat and providing weapon strikes from a remote, geographically separate location may reduce the prevalence of PTSD, especially when compared with the estimated rates of PTSD among military personnel deployed and returning from the battlefield.

The lower rates of PTSD and other psychiatric disorders, such as panic disorder and major depressive disorder [18,19], among USAF aircrew (even with their exposure to combat and other high-risk events associated with the development of psychopathology) are possibly a reflection of the selection standards and stringent medical/psychiatric screening processes that ensure such military personnel have high levels of resilience prior to entering into their respective aircrew career field. For example, recent studies that involved psychological testing (cognitive and non-cognitive aptitudes) found RPA operators to have high levels (i.e., high average to superior range) of intelligence and a host of non-cognitive aptitudes associated with psychological hardiness and emotional stamina [20-23]. The psychological profiles and aptitudes of Predator/Reaper operators are consistent with AF pilots from manned airframes [24,25]. Such traits may serve to mitigate the impact of potential internal crises that may stem from involvement in combat operations. This advantage likely allows operators an increased capability to process and problem-solve during combat and interpersonal crises. The typical RPA operator is less susceptible to emotional difficulties (e.g., anger, anxiety, depression) due to having substantially lower than average scores on the personality trait of neuroticism, which is an aspect of one's disposition that has been linked to the development of mental health disorders [26,27]. Similarly, such operators tend to have a problem-focused style of coping and internal locus of control that have been found to be a protective factor against the development of PTSD [28].

Although no participants met the full criteria for PTSD following the CAPS interview, there were notable endorsements of PTSD-related symptoms within the moderate to severe levels. Of the PCL-M questions that were more frequently endorsed by subjects in the moderate to severe range, depressive and hyperarousal symptoms were common, whereas re-experiencing symptoms were less common. In particular, sleep problems, being easily startled, feeling cut off from other people, and anhedonia were commonly endorsed by both those scoring above and below the cut-off score on the PCL-M. These symptoms are consistent with previous findings [29] that documented a high level of burnout (emotional exhaustion and cynicism). Significant stressors included long work hours and frequent changes in shift rotations while having to juggle the demands of work and home life. The finding of hyperarousal symptoms as a common area of concern and problems was also found in an earlier survey of RPA operators [6]. Shift work requirements for RPA operators are known to negatively impact circadian rhythm and quality of sleep and are related to mental health disorders such as depression [30,31]. Additionally, interpersonal relationships can suffer due to the high number of hours worked without adequate periods for recovery, varying shift work, and inability of operators to disclose to others the details of their combat-related missions. All contribute to high levels of distress. So the occupational requirements of the career field lend to high levels of reporting of these sleep-related symptoms on the PCL-M and within the diagnostic criteria of PTSD. The shift work and isolation in small operational units also leave the members cut off from their community and fellow operators. These factors better account for the high rates of subjects reporting feeling cut off emotionally from their loved ones rather than general numbness that can accompany PTSD.

In many mental health clinics, a PCL-M score of 50 or above would be classified into the "clinical" range of PTSD, while a score below this threshold is often labeled "subclinical." While screening devices such as the PCL-M can be useful tools in research and clinical practice, they have notable limitations. First, cut scores vary depending on method used, goals of the user, and population measured. In practical use, the nuances of these decisions and the limitations of these screening devices can get lost on inexperienced or hurried providers, leading to an undeserved overreliance on these tools. Studies such as ours demonstrate the PCL-M is not a valid replacement for a comprehensive evaluation when making a clinical decision about the most accurate diagnosis for a patient. There was a significant positive linear relationship between exposure to remote warfare and endorsement of symptoms on the PCL-M. However, when high scorers were interviewed, the stressors they reported were not the unique features of remote combat, but rather the more mundane difficulties of life (i.e., chronically long works hours, frequently changing work shifts, high work load, etc.) in an RPA unit. This has been a recurrent theme in the admittedly limited research on RPA personnel to this point. For them, practical matters trump sensational concerns about development of serious mental health disorders or moral injury from their work duties.

Although research to this point has not found elevated rates of PTSD or other mental health disorders, there are valid reasons to continue to closely monitor RPA personnel. First, as Chappelle et al. [3] demonstrated, the career field is a stressful one, even for personnel who are screened for their emotional resiliency and coping skills. Second, we do not know the long-term impact of increased remote warfare operations. The pace of RPA operations is increasing, leading to the likelihood that personnel will be involved in more frequent killing. Finally, what happens to RPA personnel once they are removed from the RPA arena? There are questions regarding whether symptoms of PTSD or other mental health disorders will occur later in life, as it did for veterans of the Vietnam War and other recent conflicts [32-34]. Providing these pilots

and sensor operators convenient access to mental health care now may have the potential to ameliorate these future issues.

5.1 Limitations

Our study had several limitations. First, our sample size was modest and occurred at one specific base. Previous USAF School of Aerospace Medicine research has demonstrated different levels of stressors among various bases. However, this study purposefully targeted squadrons that had previously been identified as "high risk" due to operational demands and missions requirements. Therefore, there is little reason to believe that the subjects of this study were lower risk for developing PTSD than RPA operators at other squadrons.

Positive impression management, or "reverse malingering," is a known phenomenon that occurs with aviators who tend to be highly motivated to further their aviation career [35]. All subjects in this study were on flying status and likely aware that a diagnosis of PTSD could jeopardize their flying status; therefore, they might be expected to minimize potential symptoms during the study. To limit this inclination to guardedness, participants were given assurances that no individual information regarding their responses would be disclosed to their leadership (unless an issue of significant dangerousness arose, which we did not encounter) and demographic questions were grouped to increase confidentiality. It is possible that such precautions contributed to participant willingness to volunteer for the study during their busy work day. Additionally, after completing the questionnaires, many stayed after to talk informally to the researchers about their experiences in the Predator/Reaper community and appeared very candid in these discussions, which typically revolved around the practical difficulties of being an RPA operator, such as the work schedules and base locations, rather than specific operational difficulties they were experiencing.

A related limitation is that this sample in this study consisted of Predator/Reaper operators who were on active flying status. In theory, any operator who was experiencing significant emotional distress, such as symptoms of PTSD, would be identified and taken off flying status while receiving treatment. However, no screening system is perfect, and due to the propensity of aviators to "reverse malinger," their ability to function even under duress, and previous research reported above, it was reasonable to believe that some of the subjects we encountered could have unreported PTSD.

5.2 Conclusion

This investigation sampled two squadrons of RPA operators with questionnaires and a structured interview to examine the prevalence and causes of PTSD. No current cases of PTSD were identified, and of those reporting higher levels of psychological distress, none identified their engagement in remote warfare as a significant contributing factor. The most endorsed psychological distress items were common depressive/anxiety symptoms, such as sleep problems and anhedonia, which are not specific to posttraumatic stress. We believe our study adds valuable information to previous efforts to document the potential psychological issues of engaging in the modern version of combat; that is, concerns that remote warfare could lead to high levels of PTSD in combatants have not proven to be accurate to this point.

6.0 REFERENCES

1. U.S. Government Accountability Office. Air Force: actions needed to strengthen management of unmanned aerial system pilots. Washington (DC): GAO; 2014. Report No. GAO-14-316.
2. Chappelle W, McDonald K, Thompson B, Swearengen J. Prevalence of high emotional distress and symptoms of post-traumatic stress disorder in U.S. Air Force active duty remotely piloted aircraft operators (2010 USAFSAM survey results). Wright-Patterson AFB (OH): U.S. Air Force School of Aerospace Medicine; 2012. Technical Report AFRL-SA-WP-TR-2013-0002.
3. Chappelle WL, McDonald KD, Prince L, Goodman T, Ray-Sannerud BN, Thompson W. Symptoms of psychological distress and post-traumatic stress disorder in United States Air Force "drone" operators. Mil Med. 2014; 179(8 Suppl):63-70.
4. Tvaryanas AP, Thompson WT. Fatigue in military aviation shift workers: survey results for selected occupational groups. Aviat Space Environ Med. 2006; 77(11):1166-1170.
5. Tvaryanas AP, MacPherson GD. Fatigue in pilots of remotely piloted aircraft before and after shift work adjustment. Aviat Space Environ Med. 2009; 80(5):454-461.
6. Chappelle W, Goodman T, Reardon L, Thompson W. (2014). An analysis of post-traumatic stress symptoms in United States Air Force drone operators. J Anxiety Disord. 2014; 28(5):480-487.
7. Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL. Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. N Engl J Med. 2004; 351(1):13-22.
8. Kessler RC, Heeringa SG, Stein MB Colpe LJ, Fullerton CS, et al. Thirty-day prevalence of DSM-IV mental disorders among non-deployed soldiers in the US Army: results from the Army Study to Assess Risk and Resilience in Servicemembers (Army STARRS). JAMA Psychiatry. 2014; 71(5):504-513.
9. LeardMann CA, Smith TC, Smith B, Wells TS, Ryan MA, Millennium Cohort Study Team. Baseline self reported functional health and vulnerability to post-traumatic stress disorder after combat deployment: prospective US military cohort study. BMJ. 2009; 338:b1273.
10. Milliken CS, Auchterlonie JL, Hoge CW. Longitudinal assessment of mental health problems among active and reserve component soldiers returning from the Iraq war. JAMA. 2007; 298(18):2141-2148.
11. Otto JL, Webber BJ. Mental health diagnoses and counseling among pilots of remotely piloted aircraft in the United States Air Force. MSMR. 2013; 20(3):3-8.
12. American Psychiatric Association. Diagnostic and statistical manual of mental disorders: DSM-IV-TR, 4th ed. Washington (DC): APA; 2000.
13. Weathers F, Litz B, Herman D, Huska J, Keane T. The PTSD checklist (PCL): reliability, validity, and diagnostic utility. Paper presented at the Ninth Annual Meeting of the International Society for Traumatic Stress Studies; Oct 1993; San Antonio, TX.
14. Blake DD, Weather FW, Nagy LM, Kaloupek DG, Gusman FD, et al. The development of a Clinician-Administered PTSD Scale. J Trauma Stress. 1995; 8(1):75-90.
15. Weathers FW, Keane TM, Davidson JR. Clinician-administered PTSD scale: a review of the first ten years of research. Depress Anxiety. 2001; 13(3):132-156.

16. Dobie DJ, Kivlahan DR, Maynard C, Bush KR, McFall M, et al. Screening for post-traumatic stress disorder in female Veteran's Affairs patients: validation of the PTSD checklist. General Hosp Psychiatry. 2002; 24(6):367-374.
17. Lang AJ, Laffaye C, Satz LE, Dresselhaus TR, Stein MB. Sensitivity and specificity of the PTSD checklist in detecting PTSD in female veterans in primary care. J Trauma Stress. 2003; 16(3):257-264.
18. Lollis BD, Marsh RW, Sowin TW, Thompson WT. Major depressive disorder in military aviators: a retrospective study of prevalence. Aviat Space Environ Med. 2009; 80(8):734-737.
19. Marsh RW, Sowin TW, Thompson WT. Panic disorder in military aviators: a retrospective study of prevalence. Aviat Space Environ Med. 2010; 81(6):589-592.
20. Chappelle W, Swearingen J, Goodman T, Thompson B. Personality test scores that distinguish U.S. Air Force remotely piloted aircraft "drone" pilot training candidates. Wright-Patterson AFB (OH): U.S. Air Force School of Aerospace Medicine; 2014. Technical Report AFRL-SA-WP-TR-2014-0001.
21. Chappelle W, Tran NVT, Thompson W, Goodman T, Hyde K. Intelligence and neuropsychological aptitude testing of U.S. Air Force MQ-1 Predator pilot training candidates. Wright-Patterson AFB (OH): U.S. Air Force School of Aerospace Medicine; 2012. Technical Report AFRL-SA-WP-TR-2013-0003.
22. Cotton J, Chappelle WL, Heaton JN, Salinas A. Multiple aptitude normative intelligence testing that distinguishes U.S. Air Force MQ-1 Predator sensor operators from peers in the civilian general population and AC-130 gunship sensor operators. Wright-Patterson AFB (OH): U.S. Air Force School of Aerospace Medicine; 2011. Technical Report AFRL-SA-WP-TR-2011-0006.
23. Craig-Gray R, Chappelle WL, Heaton J, Salinas A. NEO PI-R normative personality data that distinguish U.S. Air Force MQ-1 Predator and MQ-9 Reaper sensor operators from AC-130 gunship sensor operators and peers in the general population. Wright-Patterson AFB (OH): U.S. Air Force School of Aerospace Medicine; 2011. Technical Report AFRL-SA-WP-TR-2011-0004.
24. King RE, Barto E, Ree MJ, Teachout MS. Compilation of pilot personality norms. Wright-Patterson AFB (OH): U.S. Air Force School of Aerospace Medicine; 2011. Technical Report AFRL-SA-WP-TR-2011-0008.
25. King RE, Barto E, Ree MJ, Teachout MS, Retzlaff P. Compilation of pilot cognitive ability norms. Wright-Patterson AFB (OH): U.S. Air Force School of Aerospace Medicine; 2011. Technical Report AFRL-SA-WP-TR-2012-0001.
26. Jylhä P, Melartin T, Isometsä E. Relationship of neuroticism and extraversion with axis I and II comborbidity among patients with DSM-IV major depressive disorder. J Affect Disord. 2009; 114(1-3):110-121.
27. Weinstock LM, Whisman MA. Neuroticism as a common feature of the depressive and anxiety disorders: a test of the revised integrative hierarchical model in a national sample. J Abnorm Psychol. 2006; 115(1):68-74.
28. Karstoft KI, Armour C, Elklit A, Solomon Z. The role of locus of control and coping style in predicting longitudinal PTSD-trajectories after combat exposure. J Anxiety Disord. 2015; 32:89-94.
29. Ouma JA, Chappelle WL, Salinas A. Facets of occupational burnout among U.S. Air Force active duty and National Guard/Reserve MQ-1 Predator and MQ-9 Reaper operators. Wright-

Patterson AFB (OH): U.S. Air Force School of Aerospace Medicine; 2011. Technical Report AFRL-SA-WP-TR-2011-0003.
30. Culpepper L. The social and economic burden of shift-work disorder. J Fam Pract. 2010; 59(1 Suppl):S3-S11.
31. Rajaratnam SM, Howard ME, Grunstein RR. Sleep loss and circadian disruption in shift work: health burden and management. Med J Aust. 2013; 199(8):S11-S15.
32. Andrews B, Brewin CR, Stewart L, Philpott R, Hejdenberg J. Comparison of immediate-onset and delayed-onset posttraumatic stress disorder in military veterans. J Abnorm Psychol. 2009; 118(4):767-777.
33. Frueh BC, Grubaugh AL, Yeager DE, Magruder KM. Delayed-onset post-traumatic stress disorder among war veterans in primary care clinics. Br J Psychiatry. 2009; 194(6):515-520.
34. Smid GE, Mooren TT, van der Mast RC, Gersons BP, Kleber RJ. Delayed posttraumatic stress disorder: systematic review, meta-analysis, and meta-regression analysis of prospective studies. J Clin Psychiatry. 2009; 70(11):1572-1582.
35. Markovits AS. Photo-refractive keratectomy (PRK): threat or millennium for military pilots? Aviat Space Environ Med. 1993; 64(5):409-411.

LIST OF ABBREVIATIONS AND ACRONYMS

CAPS	Clinician Administered PTSD Scale
PCL-M	Posttraumatic Stress Disorder Checklist-Military Version
PTSD	posttraumatic stress disorder
RPA	remotely piloted aircraft
USAF	United States Air Force